UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/527,963	03/15/2005	Vladimir Ceperkovic	66391.000002	7465

21967 7590 03/03/2009

HUNTON & WILLIAMS LLP
INTELLECTUAL PROPERTY DEPARTMENT
1900 K STREET, N.W.
SUITE 1200
WASHINGTON, DC 20006-1109

EXAMINER	
YEH, EUENG NAN	
ART UNIT	**PAPER NUMBER**
2624	

MAIL DATE	DELIVERY MODE
03/03/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/527,963	CEPERKOVIC ET AL.	
	Examiner	Art Unit	
	EUENG-NAN YEH	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 December 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-452* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-452* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 March 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *Dec 23, 2008; Dec 6, 2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Election/Restrictions

2. Applicant's election with traverse of Species II, corresponding claims 11-30, 35-39, 42-55, 66-85, 90-94, 100-112, 123-142, 147-151, 154-167, 178-197, 202-206, 212-224, 235-254, 259-263, 266-279, 290-309, 314-318, 324-336, 347-366, 371-375, 378-391, 402-421, 426-430, and 436-448 with claims 1-7, 56-62, 113-119, 168-174, 225-231, 280-286, 337-343, 392-398, and 449-452 as generic claims in the reply filed on December 15, 2008 is acknowledged.

Examiner agrees with Applicant that claim elements are related from each other and the election/restriction is withdrawn.

However, this application is rejected under following analysis.

Information Disclosure Statement

3. The information disclosure statement filed on December 6, 2006 does not fully comply with the requirements of 37 CFR 1.98(b), which requires that each non-patent publication listed in an IDS must be identified by publisher, author (if any), title, relevant

pages of the publication, and date and place of publication. The date of publication supplied must include at least the month and year of publication, except that the year of publication (without the month) will be accepted if the applicant points out in the information disclosure statement that the year of publication is sufficiently earlier than the effective US filing date and any foreign priority date so that the particular month of publication is not in issue. The publication date does not compliant with regulation for the other references listed on the IDS: citation numbers 28, 56, and 60.

Drawings

4. The drawings are objected to because of following minor informalities:

- The figure 17 is objected to as failing to comply with 37 CFR 1.84(p)(5) because they do include the following reference characters, such as 50+m-3, 60+m-1, 70+m-4 etc., not mentioned in the description.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for

consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

5. The disclosure is objected to because of the following informalities and appropriate corrections are required:

- page 22, line 19 wherein the odd number of delay elements contains 500 and 500+m-2 and the even number of delay elements (line 20) also contains 500 and 500+m-2. Please clarify it.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-448 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is indefinite about the claimed "the specified

contexts" (e.g. claim 1, line 6). For the purpose of this examination, "the specified contexts" will be interpolated as the transformed coefficients.

8. There are insufficient antecedent basis for the following limitation for claims 225-452. Claims 225-452 recite the limitation "the machine", for example from claim 225 line 2.

9. Furthermore, claims 293 and 405, lines 2 and 3 "using first **direct** transfer function" and "using second **direct** transfer function" during the decoding processing. Clarification is needed.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

11. Claims 225, 280, and 449-452 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Claims 225, 280, and 449-452 contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The new matter is "machine readable code" such as described in claim 225, line 2. Claims 226-279 and

281-336 are rejected by their dependency. Applicant may point out where or how the original specification describes this limitation.

12. Claims 1 (and therefore claims 2-55 by dependency) and 56 (and therefore claims 57-112 by dependency) are also rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Claims 1 and 56 contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claimed apparatus comprises subband transformer, probability estimator, entropy encoder, data buffer as stated in claim 1, for example, wherein these elements are more like a software program (will discussed in USC 101 software rejection below) which are lack of the structure as required for the apparatus claim.

Claim Rejections - 35 USC § 101

13. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

14. The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows (see also MPEP 2106):

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

15. Claims 1 (and therefore claims 2-55 by dependency) and 56 (and therefore claims 57-112 by dependency) are also rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 1 and 56 define encoder and decoder, respectively. However, the body of the claim lacks definite structure indicative of a physical apparatus. Furthermore, the specification indicates that the invention may be embodied as software (see specification page 9, line 5), therefore, the claim as a whole appears to be nothing more than a “system” of software elements, thus defining functional descriptive material *per se*.

Functional descriptive material may be statutory if it resides on a “computer-readable medium or computer-readable memory”. The claim(s) indicated above lack structure, and do not define a computer readable medium and are thus non-statutory for

that reason (i.e., "When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized" – Guidelines Annex IV). The scope of the presently claimed invention encompasses products that are not necessarily computer readable, and thus NOT able to impart any functionality of the recited program. The examiner suggests:

1. Amending the claim(s) to embody the program on "computer-readable medium" or equivalent; assuming the specification does NOT define the computer readable medium as a "signal", "carrier wave", or "transmission medium" which are deemed non-statutory; or

2. Adding structure to the body of the claim that would clearly define a statutory apparatus.

Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

"A transitory, propagating signal … is not a "process, machine, manufacture, or composition of matter." Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter." (*In re Nuijten*, 84 USPQ2d 1495 (Fed. Cir. 2007)).

Should the full scope of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a "signal", the claim as a whole would

be non-statutory. Should the applicant's specification define or exemplify the computer readable medium or memory (or whatever language applicant chooses to recite a computer readable medium equivalent) as statutory tangible products such as a hard drive, ROM, RAM, etc, **as well as** a non-statutory entity such as a "signal", "carrier wave", or "transmission medium", the examiner suggests amending the claim to *include* the disclosed tangible computer readable storage media, while at the same time *excluding* the intangible transitory media such as signals, carrier waves, etc.

16. Claims 113 (and therefore claims 114-167 by dependency) and 168 (and therefore claims 169-224 by dependency) are also rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention. Supreme Court precedent (*Diamond v. Diehr*, 450 U.S. 175, 184 (1981); *Parker v. Flook*, 437 U.S. 584, 588 n.9 (1978); *Gottschalk v. Benson*, 409 U.S. 63, 70 (1972); *Cochrane v. Deener*, 94 U.S. 780, 787-88 (1876)) and recent Federal Circuit decisions (*In re Bilski*, 88 USPQ2d 1385 (Fed. Cir. 2008)) indicate that a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing. While the instant claims recite a series of steps or acts to be performed, the claims neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process. In order for a process to be "tied" to another statutory category, the structure associated with another statutory category must be positively recited in a step or steps significant to the basic inventive

concept, and NOT just in association with statements of intended use or purpose, insignificant pre or post solution activity, or implicitly. For example method claim 113 performs the steps comprising: transforming data, estimating probabilities, entropy encoding, and synchronizing data, wherein none of above steps positively "tied" to another statutory category. Secondly, a qualifying transformation is NOT recited for at least the reason that the data is not claimed as representing a physical object or substance. Furthermore, there is no external depiction of the transformed/modified data, such as but not limited to a visual display.

17. Claims 225 (and therefore claims 226-279 by dependency), 280 (and therefore claims 281-336 by dependency), and 449-450 are also rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 225, 280, and 449-450 define a storage medium with a machine readable code embodying functional descriptive material. However, the claim does not define a computer-readable medium or computer-readable memory and is thus non-statutory for that reason (i.e., “When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized” – Guidelines Annex IV). The scope of the presently claimed invention encompasses products that are not necessarily computer readable, and thus NOT able to impart any functionality of the recited program. The examiner suggests amending the claim(s) to embody the program on “computer-readable

medium" or equivalent such as "A computer readable medium stores a program …"; assuming the specification does NOT define the computer readable medium as a "signal", "carrier wave", or "transmission medium" which are deemed non-statutory (refer to "note" below). Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

A "signal" (or equivalent) embodying functional descriptive material is neither a process nor a product (i.e., a tangible "thing") and therefore does not fall within one of the four statutory classes of § 101. Rather, "signal" is a form of energy, in the absence of any physical structure or tangible material.

Should the full scope of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a "signal", the claim as a whole would be non-statutory. In the case where the specification defines the computer readable medium or memory as statutory tangible products such as a hard drive, ROM, RAM, etc, as well as a non-statutory entity such as a "signal", "carrier wave", or "transmission medium", the examiner suggests amending the claim to ***include*** the disclosed tangible computer readable media, while at the same time ***excluding*** the intangible media such as signals, carrier waves, etc.

18. The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.
>
> Claims that recite nothing but the physical characteristics of a form of energy, such as a frequency, voltage, or the strength of a magnetic field, define energy or magnetism, per se, and as such are nonstatutory natural phenomena. O'Reilly, 56 U.S. (15 How.) at 112-14. Moreover, it does not appear that a claim reciting a signal encoded with functional descriptive material falls within any of the categories of patentable subject matter set forth in Sec. 101.
>
> … a signal does not fall within one of the four statutory classes of Sec. 101.
>
> … signal claims are ineligible for patent protection because they do not fall within any of the four statutory classes of Sec. 101.

Claims 337 (and therefor claims 338-391 by dependency), 392 (and therefor claims 393-448 by dependency), and 451-452 are also rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 337, 392, and 451-452 define a data signal embodied on a carrier wave with descriptive material. While “functional descriptive material” may be claimed as a statutory product (i.e., a “manufacture”) when embodied on a tangible computer readable medium, a signal or a carrier wave embodying that same functional descriptive material is neither a process (i.e., a series of steps per se.) nor a product (i.e., a tangible “thing”) and therefore does not fall within one of the four statutory classes of § 101. Rather, “signal” is a form of energy, in the absence of any physical structure or tangible material.

Claim Rejections - 35 USC § 103

19. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

20. Claims 1-13, 31-34, 56-68, 86-89, 113-125, 143-146, 168-180, 198-201, 225-237, 255-258, 280-292, 310-313, 337-349, 367-370, 392-404, 422-425, and 449-452 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Boliek et al. (US 6,141,446) and Ogata et al. (US 5,926,791).

Regarding claims 1 (apparatus), 113 (method), 225 (article) and 337 (signal), Boliek discloses a codec system comprising:

- at least one single-level direct subband transformer for receiving and transforming input data to produce transformation coefficients ("The present invention provides a compression/decompression system having an encoding portion and a decoding portion. The encoding portion is responsible for encoding input data to create compressed data, while the decoding portion is responsible for decoding previously encoded data to produce a reconstructed version of the original input data" at column 9, line 2. As depicted in Boliek figure 2, "FIG. 2 is a block diagram of one embodiment of a compression system of the present invention that employs the binary style. Note the decoding portion of the system operates in reverse order, along with the data flow. Referring to FIG. 2, an input image 201 into a multi-component handling mechanism 211. The multi-component handling mechanism 211 provides optional color space

conversion and optional handling of subsampled image components" at column 9, line 40. As depicted in Boliek figure 2, numeral 202, "In the wavelet style, the reversible wavelets block 202 performs a reversible wavelet transform. The output of block 202 is a series of coefficients" at column 9, line 58. In a summary, "The image data 201 is received and (after optimal multicomponent handling) transformed using reversible wavelets in wavelet transform block 202 … to produce a series of coefficients representing a multi-resolution decomposition of the image" at column 9, line 65);

- at least one encoding probability estimator coupled to appropriate said single-level direct subband transformer, for receiving the transformation coefficients and estimating the probabilities of symbols within the specified contexts to produce the probabilities of symbols within the specified contexts (as depicted in Boliek figure 2, numeral 205 context modeling is the probability estimator which receives the transformed coefficients from #202, wherein the context modeling, "[c]asually available information relative to the current bit to be coded that gives historically- learned information about the current bit, enabling conditional probability estimation for entropy coding" at column 6. Under context model, and the probability estimation is "part of a coding system which tracks the probability within a context" at column 7 under Probability Estimation. "… The embedded data stream is received by the context model 205, which models data in the embedded data stream based on their significance … The results of ordering and modeling comprise decisions (or symbols) to be coded by the entropy coder 206 …" at column 10, line 17);

- at least one entropy encoder coupled to appropriate said encoding probability estimator, for receiving and entropy encoding the transformation coefficients using the probabilities of symbols within the specified contexts to produce encoded data (as depicted in Boliek figure 2, numeral 206 is the entropy encoder, “A device that encodes or decodes a current bit based on a probability estimation. An entropy coder may also be referred to herein as a multi- context binary entropy coder. The context of the current bit is some chosen configuration of "nearby" bits and allows probability estimation for the best representation of the current bit (or multiple bits). In one embodiment, an entropy coder may include a binary coder, a parallel run-length coder or a Huffman coder” at column 6, under entropy coder, and, “Note that the present invention may be used with any binary entropy coder, such as the Q-coder, QM-coder or a high speed parallel coder” at column 11, line 8. See also “…The results of ordering and modeling comprise decisions (or symbols) to be coded by the entropy coder 206 …” at column 10, line 24);

- whereby said fast encoder performs lossless compression (“The present invention provides a lossless compression/decompression system. The present invention may also be configured to perform lossy compression/decompression” at column 9, line 17).

Boliek discussed the delay "In fact, there is a maximum delay between encoding and the production of a compressed output bit” at column 30, line 31. Boliek does not explicitly disclose the data buffer to synchronize data.

Ogata, in the field of endeavor of codec analysis (“This invention relates to a sub-band encoding method and apparatus and a sub-band decoding method and

apparatus" at column 1, line 11), teaches the time delay to synchronize data processing as shown in figure 4, numeral 15 is the buffer which can store delayed data and then send out data at appropriate time "The delay unit 15 has a pre-set delay time equal to the signal processing time required in the analysis LPF 13_L and the downsampling unit 14_L and, for synchronizing the high frequency band signal $XH_0[j]$ from the first downsampling unit 12_H with the low frequency band signal $XL_1[k]$ and the high frequency band signal $XH_1[k]$ from the second stage downsampling units 14_L, 14_H, delays the high frequency band signal $XH_0[j]$ for a pre-set time and sends the delayed signal to the quantizer 16c" at column 6, line 31. Without departing from the scope and spirit of Ogata's methodology, this delay unit can hold, i.e. buffer, data for a pre-set time to provide synchronization with other data then sends this delayed, i.e. synchronized, data out to next processing.

It would have been obvious at the time the invention was made, that one of ordinary skill in the art would have been motivated to include the codec system Boliek made with the time delay buffer as taught by Ogata, in order to provide appropriate time delay to synchronize data flow as discussed above.

Regarding claims 56 (apparatus), 168 (method), 280 (article), and 392(signal) of the decoding system (As the decoding system goes through the substantially same processes as the coding system does and "the decoding portion of the system operates in reverse order, along with the data flow. Referring to FIG. 2" at Boliek column 9, line 42. Please reference to the corresponding encoding process for the discussions).

Regarding claims 2, 114, 226, and 338: - at least one quantizer coupled to appropriate said single-level direct subband transformer, for receiving and quantizing the transformation coefficients to produce quantized transformation coefficients (as depicted in Boliek figure 2, numeral 203, “These coefficients are received by the embedded order quantization block 203” at Boliek column 10, line 7);

- each said encoding probability estimator is coupled to appropriate said quantizer, for receiving the quantized transformation coefficients and estimating the probabilities of symbols within the specified contexts to produce the probabilities of symbols within the specified contexts (as depicted in Boliek figure 2, numerals 203 and 205 are quantizer and probability estimator, respectively and #205 is coupled to #203 to receive quantized coefficients and estimate the probabilities of symbols as discussed in claim 1 for the probability estimator);

- each said entropy encoder is coupled to appropriate said encoding probability estimator, for receiving and entropy encoding the quantized transformation coefficients using the probabilities of symbols within the specified contexts to produce encoded data (as depicted in Boliek figure 2, entropy encoder #206 is coupled to probability estimator #205. Reference to claim 1 for the discussion of entropy encoder);

- whereby said fast encoder performs lossy compression (“The present invention provides a lossless compression/decompression system. The present invention may also be configured to perform lossy compression/decompression” at Boliek column 9, line 17).

Regarding decoding claims 57, 169, 281, and 393 (refer to the discussions in claims 2, 114, 226, and 338. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 3, 115, 227, and 339: - at least one synchronization memory coupled to appropriate said entropy encoder, for receiving and substantially synchronizing the encoded data with a fast encoder to produce synchronized compressed data (as discussed in claim 1, the delay unit of Ogata figure 4, numeral 15 is the synchronization memory to produce synchronized compressed data);

- said output compressed buffer is coupled to said synchronization memories, for receiving and buffering synchronized compressed data to produce the output compressed data (as discussed in claim 1, the delay unit of Ogata figure 4, numeral 15 is the compressed buffer for receiving and buffering synchronized data before output to next processing).

Regarding decoding claims 58, 170, 282, and 394 (refer to the discussions in claims 3, 115, 227, and 339. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 4, 116, 228, and 340, at least one color space converter for converting an original input image to produce the input data (as depicted in Boliek figure 2, numeral 211, “The multi-component handling mechanism 211 provides optional color space conversion” at column 9, line 45).

Regarding decoding claims 59, 171, 283, and 395 (refer to the discussions in claims 4, 116, 228, and 340. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 5 117, 229, and 341: - first said single-level direct subband transformer is coupled to receive and transform the input data to produce transformation coefficients (as depicted in Ogata figure 4, x[i] is the input data and boxes 11H and 11L are the first single-level subband transformer);

- each other said single-level direct subband transformer is coupled to receive and transform selected transformation coefficients to produce transformed transformation coefficients (as depicted in Ogata figure 4, boxes 13H and 13L are other transformer).

Regarding decoding claims 60, 172, 284, and 396 (refer to the discussions in claims 5 117, 229, and 341. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 6, 118, 230, and 342, selected transformation coefficients are low-pass transformed for one-dimensional input data ("The input may include image, audio, one-dimensional (e.g., data changing spatially or temporally), two-dimensional (e.g., data changing in two spatial directions (or one spatial and one temporal dimension)), or multi-dimensional/multi-spectral data" at Boliek column 1, line 43).

Regarding decoding claims 61, 173, 285, and 397 (refer to the discussions in claims 6, 118, 230, and 342. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 7, 119, 231, and 343, selected transformation coefficients are low-pass transformed both horizontally and vertically for two-dimensional input data ("The input may include image, audio, one-dimensional (e.g., data changing spatially or temporally), two-dimensional (e.g., data changing in two spatial directions (or one spatial and one temporal dimension)), or multi-dimensional/multi-spectral data" at Boliek column 1, line 43. "The most common way to perform the transform on two-dimensional data, such as an image, is to apply the one-dimensional filters separately, i.e., along the rows and then along the columns. The first level of decomposition leads to four different bands of coefficients, referred to herein as SS, DS, SD, and DD. The letters refer to the smooth (S) and detail (D) filters defined above, which correspond to low (L) and high (H) pass filters respectively. Hence, the SS band consist of coefficients from the smooth filter in both row and column directions" at column Boliek 16, line 45. Furthermore, "In the present invention, each tree comprises the SS coefficients and three subtrees, namely the DS, SD and DD subtrees … The root of each tree is a purely smooth coefficient" at Boliek column 17, line 65).

Regarding decoding claims 62, 174, 286, and 398 (refer to the discussions in claims 7, 119, 231, and 343. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 8, 120, 232, and 344:, said single-level direct subband transformer comprises: at least one direct filter for horizontal filtering; and at least one direct filter for vertical filtering ("The most common way to perform the transform on two-dimensional data, such as an image, is to apply the one-dimensional filters separately, i.e., along the rows and then along the columns. The first level of decomposition leads to four different bands of coefficients, referred to herein as SS, DS, SD, and DD. The letters refer to the smooth (S) and detail (D) filters defined above, which correspond to low (L) and high (H) pass filters respectively. Hence, the SS band consist of coefficients from the smooth filter in both row and column directions" at column Boliek 16, line 45, wherein the row means horizontal direction and column means vertical direction).

Regarding decoding claims 63, 175, 287, and 399 (refer to the discussions in claims 8, 120, 232, and 344. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 9, 121, 233, and 345, said direct filter for horizontal filtering is different from said direct filter for vertical filtering ("The reversible wavelet transform of the present invention may be implemented using a set of filters. In one embodiment, the filters are a Two-tap low-pass filter and a Six-tap high-pass filter to implement a transform referred to herein as the TS transform, or 2,6 transform. In another embodiment, the filters are a Two-tap low-pass filter and a Ten-tap high-pass filter to implement a transform referred to herein as the TT transform, or 2,10 transform" at Boliek column 16, line 29).

Regarding decoding claims 64, 176, 288, and 400 (refer to the discussions in 9, 121, 233, and 345. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 10, 122, 234, and 346, at least one direct non-stationary filter ("One use of the location of edges is for adaptive filtering that preserves edges while reducing ringing artifacts. One way of implementing this is to use the 5-tap low pass filter …" at Boliek column 40, line 22. Without departing from Boliek's methodology, the adaptive filtering teaches the concept of non-stationary filter or serially coupled non-stationary filter according the application).

Regarding decoding claims 65, 177, 289, and 401 (refer to the discussions in claims 10, 122, 234, and 346. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 11, 123, 235, and 347, said single-level direct subband transformer comprises at least one direct filter for filtering (the one direct filter is discussed in claims 8, 120, 232, and 344).

Regarding claims 66, 178, 290, and 402 (refer to the discussion in claims 11, 123, 235, and 347. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 12, 124, 236, and 348, said direct filter comprises at least one direct non-stationary filter (the one direct non-stationary filter is discussed in claims 10, 122, 234, and 346).

Regarding claims 67, 179, 291, and 403 (refer to the discussion in claims 12, 124, 236, and 348. See also the discussion in claims 56, 168, 280, and 392).

Regarding claim 13, 125, 237, and 349, said direct non-stationary filter comprises a plurality of serially coupled direct non-stationary filter cells (the concept of serially coupled direct non-stationary filter cells is discussed in claims 10, 122, 234, and 346).

Regarding claims 68, 180, 292, and 404 (refer to the discussion in claims 13, 125, 237, and 349. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 31, 143, 255, and 367, said encoding probability estimator comprises at least one adaptive histogram updating means, for updating an adaptive histogram ("A binary arithmetic coder where additions have been substituted for multiplications and probabilities limited to discrete values and probability estimates are updated when bits are output" at Boliek column 7, under Q-Coder. Thus, probabilities, i.e. the frequency distribution of the histogram, is updated for each input data which is an adaptive, i.e. wavelet transformed, data).

Regarding decoding claims 86, 198, 310, and 422 (refer to the discussions in claims 31, 143, 255, and 367. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 32, 144, 256, and 368, a low-pass filter for filtering probabilities selected from a group consisting of: probabilities of occurrences of a current symbol x; and cumulative probabilities of occurrences of all symbols preceding the current symbol x ("The outcome in a binary decision with less Probable than 50% probability. When the two are equally probable, it is unimportant which is designated mps or lps as long as both the encoder and decoder make the same designation" at Boliek column 7, under LPS. Thus, Boliek teaches the concept to calculate probabilities of less probable symbol x, i.e. low-pass filter for cumulative probabilities preceding the current symbol x).

Regarding decoding claims 87, 199, 311, and 423 (refer to the discussions in claims 32, 144, 256, and 368. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 33, 145, 257, and 369, a dominant pole adapter for adapting a dominant pole of said low-pass filter ("The outcome of a binary decision with more than 50% probability" at Boliek column 7 under MPS, wherein the more than 50% probability is a dominant pole adapter which has dominant, more than 50%, probability).

Regarding decoding claims 88, 200, 312, and 424 (refer to the discussions in claims 33, 145, 257, and 369. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 34, 146, 258, and 370, dominant pole divider for halving a value of the dominant pole in each adaptation cycle (as discussed in claim 33, the dominant pole divider can halving, 50%, of probability thus halving the dominant pole in each adaptation cycle).

Regarding decoding claims 89, 201, 313, and 425 (refer to the discussions in claims 34, 146, 258, and 370. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 449, 450, 451, and 452 (“The present invention also relates to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magneto-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus … In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein” at Boliek column 5, line 10).

21. Claims 40-41, 95-96, 152-153, 207-208, 264-265, 319-320, 376-377, and 431-432 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Boliek et al. (US 6,141,446) and Ogata et al. (US 5,926,791) as applied to claims 1, 56, 113, 168, 225, 280, 337, and 392 discussed above, and further in view of Magenheimer et al. (IEEE Transactions on Computers, Vol. 37, No. 8, August 1988, 980-990).

Regarding claims 40, 152, 264, and 376, the Boliek and Ogata combination teaches an entropy codec system. The Boliek and Ogata combination does not explicitly disclose the encoder range divider.

Magenheimer, in the field of endeavor of processing efficiency ("clever programming allows the Hewlett-Packard Precision Architecture integer multiplication and division implementation to provide adequate performance at little or no hardware cost" at page 980 abstract), teaches an efficient way of division "A well-known example is division by a power of 2. On a binary machine, this becomes a matter of shifting … it is usually far faster to do an adjustment and then shift than to go through the general division algorithm for powers of 2. Under the Precision Architecture, division by small powers of 2 can be done in one instruction …" at page 987, left column, first paragraph. Furthermore, "We are interested in the integer quotient of two numbers, x and y. It is assumed that y is a known constant and that x is a variable. For simplicity in the discussion that follows, assume that x >= 0 and y > 0 … So we want to compute the function q(x) such that q(x) = Floor (x/y). Our technique is to find an inexpensive way to multiply x by the reciprocal of y … if x is in the range ky <= x < (k+1)y for some k, then

we must have k <= q'(x) = (ax + b) / z < (k+1) …" at page 987, left column, under section of Division Problem Description for more detail discussion about the division. Without departing from the scope and spirit of Magenheimer's methodology, the variable x can be the range R and the known constant can be the number Total of occurrence of all symbols.

It would have been obvious at the time the invention was made, that one of ordinary skill in the art would have been motivated to include the codec system Boliek and Ogata made with range divider as taught by Magenheimer in order to have a fast processing as stated above.

Furthermore, as stated by the applicant, "FIG. 39 is a flowchart of the state-of-the-art range encoder, which is together with the state-of-the-art range decoder called OLD CODER, as was disclosed in G. N. N. Martin. "Range encoding: and algorithm for removing redundancy from a digitised message," Proc. Video & Data Recording Conf., Southampton, UK, Jul. 24-27, 1979; M. Schindler "A fast renormalization for arithmetic coding," Poster at DDC, Data Compression Conf., Snowbird, Utah, Mar. 30-Apr. 1, 1998; and Internet location http://www.compressconsult.com/rangecoder/." at specification page 39, line 3. Thus the above stated three references contain the claimed subject.

Regarding decoding claims 95, 207, 319, and 431 (refer to the discussions in claims 40, 152, 264, and 376. See also the discussion in claims 56, 168, 280, and 392).

Regarding claims 41, 153, 265, and 377, said first divider comprises a first right shifter for shifting right said range R for $w_3 = \log_2$ (Total) bit positions ("… shifts are given with respect to this size. A shift of n is a multiplication by 2^n" at Boliek column 21, line 32. For example, the value of R is 64 then the binary representation of R is 1000000 (= 2^6 = 64 = R). If Total is 2 (i.e. 2^1) then the right shifting 1 bit of binary R becomes 100000 (= 2^5 = 32 = $R/2^1$). If Total is 4 (i.e. 2^2) then the right shifting 2 bits of binary R becomes 10000 (= 2^4 = 16 = $R/2^2$). And the left shifting is multiplication by 2^n).

Regarding decoding claims 96, 208, 320, and 432 (refer to the discussions in claims 41, 153, 265, and 377. See also the discussion in claims 56, 168, 280, and 392).

Examiner's Comments

22. Claims 14-30, 35-39, 42-55, 69-85, 90-94, 97-112, 126-142, 147-151, 154-167, 181-197, 202-206, 209-224, 238-254, 259-263, 266-279, 293-309, 314-318, 321-336, 350-366, 371-375, 378-391, 405-421, 426-430, and 433-448 would be allowable if amended to overcome the USC101 and 112 rejections set forth in this Office action above and rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance:

The present application comprises the following features in combination with other recited limitations, which the closest prior art of record and the references cited in form PTO-1449 taken either singly or in combination does not teach or suggest:

a) said direct non-stationary filter cell comprises: a filter device (805); a filter cell input x coupled to said filter device (805); a filter cell output y coupled to said filter device (805); a first switch (800) and a second switch (801) coupled to said filter device (805), having a plurality of positions controlled by a clock input c; and a clock input c coupled to control said first switch (800) and said second switch (801), for providing a non-stationarity of said direct non-stationary filter cell (dependent claim 14).

b) said entropy encoder is a range encoder, comprising a first multiplier for multiplying a prescaled range r with a number Q(x) selected from a group consisting of: a number U(x) of occurrences of all symbols preceding a current symbol x, to produce a range correction t = r . U(x); and a number u(x) of occurrences of the current symbol x, to produce a range R = r . u(x) (dependent claims 35, 147, 259, 371).

c) said encoding probability estimator comprises: a transformation coefficient C splitter into a sign S and a magnitude M; a magnitude-set index MS determinator coupled to said transformation coefficient C splitter, for determining the magnitude-set index MS using said magnitude M and a magnitude-set table; a residual R determinator, coupled to said transformation coefficient C splitter, for determining a residual R using said magnitude M and said magnitude-set table (dependent claims 42, 154, 266, 378).

d) said inverse non-stationary filter cell comprises: a filter device (805); a filter cell input x coupled to said filter device (805); a filter cell output y coupled to said filter

device (805); a first switch (800) and a second switch (801) coupled to said filter device (805), having a plurality of positions controlled by a clock input c; and a clock input c coupled to control said first switch (800) and said second switch (801), for providing a non-stationarity of said direct non-stationary filter cell (dependent claim 69).

e) said entropy decoder is a range decoder, comprising a first multiplier for multiplying a prescaled range r with a number Q(x) selected from a group consisting of: a number U(x) of occurrences of all symbols preceding a current symbol x, to produce a range correction t = r . U(x); and a number u(x) of occurrences of the current symbol x, to produce a range R = r . u(x) (dependents claims 90, 202, 314, 426).

f) said entropy decoder is a range decoder, comprising a second divider for dividing a bottom range limit B with a prescaled range r, to produce a range correction t=bottom(B/r) (dependent claims 97, 209, 321, 433).

g) said direct non-stationary cell filtering comprises: filtering using first direct transfer function in the first cycle; and filtering using second direct transfer function in the second cycle (dependent claims 126, 238, 350).

h) said inverse non-stationary cell filtering comprises: filtering using first inverse transfer function in the first cycle; and filtering using second inverse transfer function in the second cycle (dependent claims 181, 293, 405).

i) reconstruct transformation coefficient C, using a magnitude-set index MS, a sign S and a residual R (dependent claims 324, 436).

Conclusion

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eueng-nan Yeh whose telephone number is 571-270-1586. The examiner can normally be reached on Monday-Friday 8AM-4:30PM EDT.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wenpeng Chen can be reached on 571-272-7431. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Eueng-nan Yeh
Assistant Patent Examiner
Art Unit: 2624
/E.Y./

/Wenpeng Chen/

Primary Examiner, Art Unit 2624 2/26/09